

Review Article

Review of the Incidence and Management of Meckel's Diverticulum

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Abstract

Meckel's Diverticulum has an estimated prevalence of 1.2% of the population. Most cases are asymptomatic and the diagnosis is often made intra-operatively. Surgical resection is the treatment of choice in patients with symptomatic Meckel's Diverticulum or in cases of complication such as obstruction, bleeding or Meckel's diverticulitis. However, the management of asymptomatic incidentally discovered Meckel's Diverticulum has been more controversial. Some groups still recommend resection due to the risk of long-term complications, while others do not recommend resection citing the increased risk of post-operative morbidity in comparison to long-term complications. There are an increasing number of case reports documenting the association of Meckel's Diverticulum with the risk of malignancy and new population-based studies confirm this association. More studies are needed, but the potential impact on the management of asymptomatic Meckel's Diverticulum cannot be ignored.

Keywords: Meckel's Diverticulum; Incidence; Anatomy

Introduction

Meckel's Diverticulum is the most common congenital abnormality of the gastrointestinal tract. It is estimated to be present in 1.2% of the population and is associated with a number of complications. Pre-operative diagnosis can be difficult. In adults, the diagnosis is usually made intra-operatively, therefore pre-operative history, exam findings and supportive imagings are essential to making a timely diagnosis. We review the incidence, presentation and evaluation of Meckel's diverticulosis and diverticulitis. We also discuss the controversy regarding the management of asymptomatic Meckel's Diverticulum and new evidence that may suggest that a more aggressive approach may be warranted.

Anatomy and Incidence

Meckel's Diverticulum is the most common congenital abnormality of the gastrointestinal tract [1]. It is a remnant of the omphalomesenteric or vitelline duct which connects the yolk sac to the midgut through the umbilical cord. Failure of this duct to obliterate during the eighth week in utero can result in several abnormalities including enterocyst, omphalomesenteric fistula or Meckel's Diverticulum [1]. Meckel's Diverticulum is true diverticula, containing all layers of bowel wall; it is usually found within 100 cm of the ileocecal valve. It was previously estimated that Meckel's Diverticulum can be found in 2% of the general population; however, more recent studies have shown this to be an overestimate, with the real incidence being approximately 1.2% based on a review of more than 50 years of autopsy studies [2]. Males are more commonly affected by a ratio of 1.5-4:1 depending on the series [1-6].

Presentation

Most cases of Meckel's Diverticulum are asymptomatic; this is true in both the pediatric and adult populations. In a review of 1476

cases from the Mayo Clinic, 86% of patients were asymptomatic [5]. In a recent review of 815 patients age 18 years and under who underwent Meckel's diverticulectomy over a two year period, 60% were found to be asymptomatic [6]. In symptomatic cases, the most common symptoms were bleeding, obstruction and diverticulitis which can mimic acute appendicitis [1-6]. Other complications in the acute presentation of symptomatic Meckel's Diverticulum include intussusception, perforation and volvulus [1-3]. In the pediatric population, males comprised 74% of cases of resection for symptomatic Meckel's Diverticulum; overall, diverticulectomy was two times more common in pediatric males than females [6]. Adults are more likely to present with symptomatic disease [5].

Ectopic tissue is a common finding in Meckel's Diverticulum, however the incidence of this finding varies depending on the presentation (symptomatic versus asymptomatic) and the population (adult versus pediatric) examined. In the review from the Mayo Clinic, ectopic tissue was found in 43% of symptomatic adults who underwent resection for Meckel's Diverticulum [5]. The most common ectopic tissues identified were gastric, pancreatic and carcinoid [5]. In asymptomatic adults 14% were found to have ectopic tissue; again, gastric, pancreatic and carcinoid were the most common findings [5]. In symptomatic pediatric patients, 59% were found to have ectopic mucosa with gastric, pancreatic and colonic being most prevalent [5]. In asymptomatic pediatric patients, 11% were found to have ectopic tissue after resection which included gastric and pancreatic tissue [5]. It is evident that ectopic mucosa is more likely to be associated with complications; 75-90% of bleeding Meckel's Diverticulum are found to have ectopic gastric mucosa [1,5].

Diagnosis

With the exception of the pediatric patient presenting with lower gastrointestinal bleeding, Meckel's Diverticulum is seldom on the

differential diagnosis for any other patient group presenting with abdominal complaints. The diagnosis is rarely made prior to surgical intervention. Several imaging methods may be used to help make the diagnosis. Plain radiographs may help identify complications such as perforation and small bowel obstruction; however there are no findings which are specific enough to confirm or exclude the possibility of Meckel's Diverticulum on plain radiographs [7]. Upper gastrointestinal contrast studies may show a single Diverticulum arising from the antimesenteric border of the distal ileum [7]. The sensitivity of small bowel contrast studies is quite variable; barium studies appear to be more useful in adults than the pediatric population [7]. Ultrasound is used more often in the pediatric population; it is often the case that inflamed Meckel's Diverticulum which is visualized on ultrasound is interpreted as appendicitis [7, 8]. Findings on ultrasound suggestive of Meckel's diverticulitis include a tubular, hypoechoic structure, or a complex mass [8]. Other findings include a non-compressible, cystic mass with a thickened wall, or a blind-ending sac [7]. Ultrasound is not the most sensitive technique for detecting Meckel's Diverticulum, and an inflamed Diverticulum may appear similar to a duplication cyst [7]. The appearance of Meckel's Diverticulum on Computed Tomography (CT) may be difficult to distinguish from normal bowel and will vary depending on the complication. In cases of Meckel's diverticulitis, the area may appear as a thick-walled loop of bowel in the region of the terminal ileum with surrounding inflammation and separate from the appendix [7].

If enteroliths are present, these will appear as heavily calcified stones within the Diverticulum [7]. The Meckel's scan uses technetium-99m pertechnetate which is taken up by ectopic gastric mucosa. This nuclear medicine scan is highly specific at 95%, however the sensitivity is around 85% in children and decreases to 54-60% in adults [7,9]. False positive results may be seen in duodenal or jejunal duplication cysts which contain gastric mucosa, also in cases of volvulus, inflammatory bowel disease and in post-op patients [7]. False negative scans may be seen in cases of Meckel's Diverticulum where ectopic gastric mucosa is absent [7]. Barium attenuates gamma radiation, and the Meckel's scan should not be performed if there is residual barium in the gastrointestinal tract [7]. Endoscopically, the use of capsule endoscopy and double balloon endoscopy and identify areas of abnormality, particular in patients who present with symptoms such as bleeding [10]. There is no comparative data on the sensitivity of these studies, but one should be aware that these studies make preoperative evaluation of the entire GI tract feasible in cases that may be difficult to diagnose.

Management

Surgical resection is the treatment for symptomatic Meckel's Diverticulum; this may include simple diverticulectomy or bowel resection. Diverticula with a broad base or those associated with complications such as hemorrhage are removed by bowel resection. Laparoscopic resection has also been reported in both the pediatric and adult population as a safe option [6,11]. Symptomatic and pathologic Meckel's Diverticulum discovered at the time of operation for other indications should be resected. The question of whether to resect asymptomatic Meckel's Diverticulum incidentally discovered during surgery for other indications has been debated for decades. Previous authors have proposed resection of incidental Meckel's Diverticulum citing the low operative morbidity associated with resection in

comparison to the estimated 5-6% lifelong risk of complications associated with unresected Diverticulum [12]. Cullen et al reported a 6% lifetime risk of developing complications necessitating surgical management in both males and females [13]. The risk of long-term complications after the resection of incidentally discovered Meckel's Diverticulum was 2% over 20 years; this was in comparison to the 7% long-term complication rate seen after resection performed due to complications of Meckel's Diverticulum [13]. This group concluded that, regardless of age, resection for incidental Meckel's Diverticulum was indicated. Park and colleagues reported a morbidity of 20% and mortality of 3% after surgical resection for asymptomatic Meckel's Diverticulum compared to 13% and 0% respectively in the symptomatic group; none of the complications in the asymptomatic group directly correlated with the diverticulectomy itself [5]. This group recommended simple diverticulectomy unless a palpable mass was present, in which case a small bowel resection would be required in order to ensure that all ectopic tissue is removed; removal was recommended unless other conditions such as generalized peritonitis would make removal hazardous [5]. Those who argue against resection of incidentally discovered Meckel's diverticulacite the decreasing risk of developing complications with age, and the increased risk of postoperative morbidity [2,14]. Based on their systematic review on the prevalence of Meckel's Diverticulum and its complications, Zani et al concluded that the actual prevalence was approximately 1.2%; 4% would require hospitalization at some point in their lifetime, while only 3% would end up having a surgical intervention [2]. With a 5% postoperative complication rate in asymptomatic, incidental cases, the authors advised against surgical resection in this population [2]. It is estimated that between 758-800 patients would need to undergo resection of incidental Meckel's diverticula to prevent one death [2,14].

More recently, another long-term complication of Meckel's Diverticulum has been more extensively investigated. While there have been many published case reports and small series documenting incidental malignancies associated with Meckel's Diverticulum [15,17]. Thirunavukarasu et al report 158 cases of Meckel's Diverticulum associated cancer between 1973 and 2006 in a population based study using the Surveillance, Epidemiology and End Results (SEER) database from the National Cancer Institute [18]. This corresponded to an annual incidence of 1.44 per 10 million populations and increased with every decade of life with a peak in the eighth decade [18]. It was noted that the incidence in males was 2.3 times higher compared to females [18]. Carcinoid was the most common cancer found, followed by adenocarcinoma, Gastrointestinal Stromal Tumor (GIST) and lymphoma. Fifteen percent of patients were found to have regional (node positive) metastatic disease, while 10% had distant metastases [18]. The presence of Meckel's Diverticulum was found to be associated with a significantly increased incidence of cancer development compared to other parts of the ileum [18]. Based on these results, the authors affirm that the benefits of resection for Meckel's diverticula discovered incidentally at the time of surgery outweighed the risks due to the increased incidence of cancer development [18]. The risk of cancer formation continued to increase over time [18]. Some dispute the conclusions of this study stating that the numbers still indicate a very low rate of occurrence with a high number (approximately 6000) needed to treat

to prevent one cancer death [19]. The authors refute this claim by stating that using the updated estimates of the prevalence of Meckel's Diverticulum (1%), the number needed to treat to prevent one case of cancer is between 245 and 300; this estimate may be even lower if specific population incidence rates are used rather than the crude annual incidence rate [19]. The findings of this study have also led to others changing their previous stance to favor resection of incidental Meckel's Diverticulum [20]; some argue that the significant rate of regional and distant metastatic disease warrants that Meckel's Diverticulum associated cancer be managed aggressively with bowel resection and lymphadenectomy [16,17,21].

Conclusion

Meckel's Diverticulum is the most common congenital abnormality of the gastrointestinal tract. Historically the incidence of Meckel's Diverticulum has been reported to be around 2%; however it is likely closer to 1%. Complications include bleeding, obstruction, perforation and volvulus. Surgical resection is the treatment for symptomatic and pathologic Meckel's diverticula discovered at the time of surgery. The issue of whether to resect asymptomatic, incidentally discovered Meckel's diverticula has been contested for decades, however new research has shown that there is an increased incidence of carcinoma associated with Meckel's Diverticulum; this risk continues to increase with age, peaking during the eighth decade of life. This increased risk of malignancy in addition to the high rate of regional and distant metastatic disease observed in Meckel's Diverticulum associated carcinoma will likely become important factors in the ongoing debate regarding the treatment of patients with asymptomatic, incidentally discovered Meckel's diverticula.

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